Claims

1. An operation system for a shoulder joint prosthesis, having two cooperating bearing bodies (11, 102), in particular a joint head (11) and a joint shell (102), a shaft (15) and a coupling (17) to connect the shaft (15) to one of the bearing bodies (11), comprising

- a positioning device by means of which the shaft (15) can be positioned at a desired depth in the bone (19) without a coupling (17);

- a pre-fixing device by means of which the desired position of the bearing body (11) relative to the coupling (17) can be pre-fixed at the shaft (15) positioned at the desired depth; and

- a final fixing device by means of which, with the coupling (17) removed from the shaft (15), the pre-fixed desired position can be finally fixed.

2. An operation system in accordance with claim 1, wherein the coupling (17) for connection to the shaft (15) includes a clamping section (21) with which a firm clamped seating of the coupling (17) in the shaft (15) can be established by hammering into a coupling mount (23) of the shaft (15).

3. An operation system in accordance with claim 2, wherein the clamping section (21) tapers conically and can be hammered into a correspondingly shaped coupling mount (23) of the shaft (15), with the clamping section (21) having an outer cross-section different from a circular shape.

4. An operation system in accordance with claim 1, wherein the positioning device has a bearing section (31) fixable to the shaft and at least one positioning element (35) mounted pivotally and rotatably at the bearing section (31) and axially immovable in the direction of a longitudinal axis (33) relative to the bearing section (31) with a lower side (37) which faces the shaft (15), which serves as a depth stop and can be brought into all orientations coming into question for the bearing body (11) relative to a prepared planar upper side (25) of the bone (19) by pivoting and/or rotating of the positioning element (35) relative to the bearing section (31).

5. An operation system in accordance with claim 4, wherein the bearing section (31) of the positioning device is made as a spherical bearing, with the center of the spherical bearing and the lower side (37) of the positioning element (35) being matched to one another with respect to their relative axial position such that, with the shaft (15) positioned at the desired depth and the bearing section (31) fixed to the shaft (15), the position of the center of the spherical bearing coincides with the desired position of the center of a spherical bearing section (27) of the coupling (17).

6. An operation system in accordance with claim 4, wherein the positioning element (35) corresponds at least approximately to the bearing body (11) with respect to the shape and to the size of its planar lower side (37) and to the position, in particular to the eccentric position, of a mount (39) opening at the lower side (37).

7. An operation system in accordance with claim 4, wherein the positioning element (35) is provided in the form of an annular disk.

8. An operation system in accordance with claim 4, wherein a plurality of positioning elements (35) are provided which differ from one another with respect to the shape and to the size of their planar lower sides (37) and to the position of a mount (39) opening at the lower side (37).

9. An operation system in accordance with claim 4, wherein the positioning element (35) has at least one pressing screw which can be brought from a neutral position into a pressure position projecting from the lower side (37) of the positioning element (35) to press the positioning element (35) from the upper side (25) of the bone (19).

10. An operation system in accordance with claim 4, wherein the bearing section (31) of the positioning device has a coupling section (43) which is insertable into a coupling mount (23) of the shaft (15) and which has an outer shape matched to the inner cross-sectional shape of the coupling mount (23) differing from a circular shape to align the positioning device relative to the shaft (15).

11. An operation system in accordance with claim 4, wherein a transition is formed as a supporting and sealing area (45) between the bearing section (31) and the coupling section (43) of the positioning device, said supporting and sealing area contacting the shaft (15) when the bearing section (31) is fixed to the shaft (15) and sealing the

interior of the shaft with respect to the environment.

12. An operation system in accordance with claim 4, wherein the bearing section (31) can be fixed to the shaft (15) by means of a clamping device (47) of the positioning device, with the clamping device (47) cooperating with an existing internal thread (29) formed in a coupling mount (23) of the shaft (15).

13. An operation system in accordance with claim 4, wherein the bearing section (31) is provided with a cylindrical surface region (49) to attach the positioning element (35).

14. An operation system in accordance with claim 13, wherein the center axis of the cylindrical surface region (49) has an inclination with respect to a longitudinal axis (33) of the bearing section (31) which is outside a zone of inclinations which the positioning element (35) can adopt during the shaft positioning.

15. An operation system in accordance with claim 1, wherein the pre-fixing device includes a support member (51) which can be axially fixed in a coupling mount (23) of the shaft (15) and serves in the fixed state as an end stop for a clamping section (21) of the coupling (17) which can be secured in the coupling mount (23) by hammering in, with the support member (51) being matched to the dimensions of the shaft (15) and of the damping section (21) such that the support member (51) intercepts the clamping section (21) at a pre-fixing depth allowing a simple removal of the coupling (17)

before reaching a desired depth required for the securing.

16. An operation system in accordance with claim 15, wherein the support member (51) can be axially fixed by screwing into the shaft (15) while utilizing an existing internal thread (29) formed in the coupling mount (23) of the shaft (15).

17. An operation system in accordance with claim 15, wherein the pre-fixing device includes a compensation member (53) which can be brought between the bone (19) and the bearing body (11) to compensate the difference between the desired depth and the pre-fixing depth and is made such that an alignment of the lower side (13) of the bearing body (11) parallel to the upper side (25) of the bone (19) is ensured.

18. An operation system in accordance with claim 17, wherein the compensation member (53) is provided in the form of a spring disk which is made in one piece and includes a plurality of spring tongues projecting from a base plate (55).

19. An operation system in accordance with claim 1, wherein the pre-fixing device includes a spreading element (59), which can be introduced into a spreadable spherical bearing section (27) of the coupling (17) and can be driven, for the pre-fixing spreading of the spherical bearing section (27), into said spherical bearing section (27) by hammering the coupling (17) into the shaft (15) - with the bearing body arranged on its spherical bearing section (27) - by means of the support member (51) axially fixed in the shaft (15).

20. An operation system in accordance with claim 1, wherein the final fixing unit includes a clamping apparatus (71) to clamp the bearing body (11) pre-fixed at the coupling (17) between an adjustable holding member (73) and a fixed supporting member (75) as well as a driving tool with which a spreading element (59) pre-fixing the bearing body (11) can be driven into a final fix position to finally fix the bearing body (11) when the bearing body (11) is clamped in.

21. An operation system in accordance with claim 20, wherein the driving tool to drive in the spreading element (59) while using an existing internal thread (22) formed in a clamping section (21) of the coupling (17) can be screwed into the clamping section (21), with the final fixing position of the spreading element (59) being pre-determined by a specific screw-in torque of the driving tool.

22. An operation system in accordance with claim 20, wherein the support member (75) has a supporting surface (77) for the lower side (12) of the bearing body (11) and a throughgoing receiving passage (79) for a clamping section (21) of the coupling (17) via which the clamping section (21) is accessible to the driving tool, on the one hand, and which is made as a rotational security for the coupling (17) due to its internal cross-section matched to the outer cross-section of the clamping section (21) differing from a circular shape, on the other hand.

23. An operation system in accordance with claim 22, wherein the support surface (77) of the support member (75) is inclined with respect to a longitudinal axis (81) of the final fixing device in accordance with the inclination of the bearing body (11) relative to a longitudinal axis (33) of the coupling (17).

24. An operation system in accordance with claim 20, wherein the final fixing device includes two base plates (85, 87) held at a fixed axial spacing by a plurality of connection columns (83), with the holding member (73) being supported at the one base plate (85) and the support member (75) being supported at the other base plate (87).

25. An operation system in accordance with claim 1, which also comprises a hammer tool (91) with which hammer impulses can be applied to the bearing body (11) arranged on a spherical bearing section (27) of the coupling (17) to hammer the coupling (17) into the shaft (15), with the magnitude of a hammer impulse to be applied in each case being pre-settable, and in particular changeable, at the hammer tool (91).

26. A method of inserting a shoulder joint prosthesis, which has two cooperating bearing bodies (11, 102), in particular a joint head (11) and a joint shell (102), as well as a shaft (15) and a coupling (17) to connect the shaft (15) to one of the bearing bodies (11), comprising

- positioning the shaft (15) at a desired depth in the bone (19) without a coupling (17);

- prefixing the desired position of the bearing body (11) relative to the coupling (17) to the shaft (15) at the desired depth; and

- finally fixing the pre-fixed desired position with the coupling (17) removed from the shaft (15).

27. A method in accordance with claim 26, also comprising, for the positioning of the shaft (15) in the bone (19), selecting a matching positioning element (35) with reference to a piece of bone previously separated from the bone (19) from a plurality of positioning elements (35) which differ from one another with respect to the shape and to the size of their planar lower sides (37) and to the position of a mount (39) opening at the lower side (37), said positioning element (35) corresponding at least approximately to the bearing body (11) with respect to the shape and to the size of its lower side (37) and to the position of its mount opening at the lower side (37).

28. A method in accordance with claim 27, also comprising, attaching the selected positioning element (35) to a bearing section (31) in a pivotal and rotatable manner and axially unmovable in the direction of a longitudinal axis (33) relative to the bearing section (31).

29. A method in accordance with claim 28, also comprising, fixing the bearing section (31) carrying the selected positioning element (35) to the shaft (15) by means of a clamping device (47), with the clamping device (47) cooperating with an existing

internal thread (29) formed in a coupling mount (23) of the shaft (15).

30. A method in accordance with claim 29, also comprising, introducing the shaft (15) connected to the bearing section (31) carrying the selected positioning element (35) into a prepared cavity of the bone (19) and into a desired position in the bone (19) which is determined in that the lower side (37) of a positioning element (35) supported pivotally and rotatably, but axially unmovably at the bearing section (31) aligns at a prepared upper side (25) of the bone (19) in an orientation corresponding to the desired orientation of the bearing body (11) to be coupled to the shaft (15).

31. A method in accordance with claim 30, wherein the shaft (15) is definitively fixed in its desired position in the bone (19) by cementing in or by hammering in.

32. A method in accordance with claim 31, wherein the bearing section (31) and the positioning element (35) are removed from the shaft (15) and from the bone (19), with the positioning element (35) being pressed from the upper side (25) of the bone (19) by actuation of pressing screws which can be brought from a neutral position into a pressure position projecting from the lower side (37) of the positioning element (35).

33. A method in accordance with claim 26, wherein, to pre-fix the desired position of the bearing body (11) relative to the coupling (17), a support member (51) is axially fixed in a coupling mount (23) of the shaft (15) by being screwed into

the shaft (15) while utilizing an existing internal thread (29) formed in the coupling mount (23) of the shaft (15).

34. A method in accordance with claim 33, wherein a spreading element (59) is introduced into a spreadable spherical bearing section (27) of the coupling (17), with the spreading element (59) being brought into a pre-determined starting position in which the spherical bearing section (27) of the coupling (17) is slightly spread by means of a plunger having a depth stop; and in that the bearing body (11) is placed onto the spherical bearing section (27) of the coupling (17) in a pivotal and rotatable manner.

35. A method in accordance with claim 34, wherein a clamping section (21) of the coupling (17) carrying the pivotal and rotatable bearing body (11) is inserted into the coupling mount (23) of the shaft (15) containing the axially fixed support member (51), with the support member (51) being matched to the dimensions of the shaft (15) and of the clamping section (21) such that the clamping section (21) is intercepted by the support member (51) at a pre-fixing depth allowing a removal of the coupling on insertion into the coupling mount (23) before reaching a desired depth required for its securing in the shaft (15).

36. A method in accordance with claim 35, wherein, before the introduction of the clamping section (21) of the coupling (17) into the coupling mount (23) of the shaft (15) to compensate the difference between the desired depth and the pre-

fixing depth, a compensation member (53) of the pre-fixing device is brought between the bone (19) and the bearing body (11).

37. A method in accordance with claim 35, also comprising, applying a hammer impulse of pre-determined magnitude to the bearing body such that the spreading element (59) previously introduced into the spherical bearing section (27) of the coupling (17) is driven further into the spherical bearing section (27) by the support member (51) axially fixed in the shaft (15) and the spherical bearing section (27) is thereby spread open so widely that the bearing body (11) is pre-fixed in its desired position relative to the coupling (17), with an alignment of the lower side (13) of the bearing body (11) parallel to the upper side (25) of the bone (19) being ensured by the compensation member (53) previously brought between the bone (19) and the bearing body (11).

38. A method in accordance with claim 37, wherein the bearing body (11) supported pivotally and rotatably at the spherical bearing section (27) of the coupling (17) is brought into its desired position relative to the bone (19) by alignment at the bone (19) before the application of the hammer impulse to the bearing body (11).

39. A method in accordance with claim 26, wherein, to finally fix a pre-fixed desired position of the bearing body (11) relative to the coupling (17), the bearing body (11) is clamped between a holding member (73) and a support member (75) of a final fixing device, and a spreading element (59)

pre-fixing the bearing body (11) is further driven into a spreadable spherical bearing section (27) of the coupling (17) into a pre-determined finally fixed position by means of a driving tool, with the driving tool being screwed into a clamping section (21) utilizing an internal thread (22) formed in the clamping section (21) of the coupling (17).

40. A method in accordance with claim 39, wherein the clamping section (21) is secured against rotation during the driving in of the spreading element (59) by means of the support member (75).

41. A method in accordance with claim 26, also comprising, removing a support member (51) from a coupling mount (23) of the shaft inserting (15), a clamping section (21) of the coupling (17) carrying the finally fixed bearing body (11) into the coupling mount (23) of the shaft (15) and applying a hammer impulse of pre-determined magnitude to the bearing body (11) such that the clamping section (21) is hammered into the finally firm clamped seating in the coupling mount (23) and the bearing body (11) is brought into its desired position relative to the bone (19).

42. A method in accordance with claim 35, wherein on the introduction of the clamping section (21) into the shaft (15), both for the pre-fixing and for the establishing of the final clamped seating, an elliptical cross-section of the clamping section (21) is aligned relative to the coupling mount (23) of the shaft (15) in its plane such that the large ellipse axis appears as a perpendicular in a projection toward lateral.

43. A method of inserting a joint prosthesis comprising, using an operation system in accordance with claim 1.